CLAIMS

1. A positioner comprising:

a base and a sample platform moveable relative to the base;

a drive mechanism arranged to act between the base and the sample platform; and

a plurality of levers extending away from each other, the levers supporting the sample platform and being connected to the drive mechanism so that actuation of the drive mechanism is transmitted under mechanical advantage of the levers to position the sample platform.

2. A positioner according to claim 1, wherein each lever is rotatably mounted on a fulcrum, thereby subdividing the levers into inner and outer arms with the inner arms connected to the drive mechanism and the outer arms supporting the sample platform.

3. A positioner according to claim 1 or 2, wherein the drive mechanism is arranged to act on the levers in the same direction.

4. A positioner according any of claims 1 to 3, wherein the drive mechanism comprises a piezoelectric element.

5. A positioner according to any of claims 1 to 4, wherein the plurality of levers comprises at least one pair of levers that extend in opposite directions to each other.

6. A positioner according to any of claims 1 to 5, further comprising a flexible hinge interconnecting at least some of the levers.

7. A positioner according to claim 6, wherein the levers are formed from a single cross member, the flexible hinge being provided by a thinned section of the cross member.

8. A positioner according to any of claims 2 to 7, further comprising support walls that connect to the levers by flexible connections to form the fulcrums.

9. A positioner according to claim 8, wherein each lever and its support wall are of unitary construction, the flexible connection being provided by a thinned junction section.

10. A positioner according to any of claims 2 to 9, wherein the fulcrums are moveable relative to one another such that the sample platform may be rotated with respect to the base.

11. A positioner according to any of claims 1 to 10, wherein the sample platform is mounted on the levers by a pair of output linkages which are stiff in respect of forces applied along their axes of extent.

12. A positioner according to claim 11, wherein the output linkages are deformable in respect of forces applied transverse to their axes of extent.

13. A positioner according to claim 11 or 12, wherein the output linkages extend away from the levers on the same side as that on which the drive mechanism is located.

14. A positioner according to any of claims 11 to 13, wherein the output linkages extend substantially parallel to a drive axis along which the drive mechanism supplies an actuation force.

15. A positioner according to any of claims 1 to 14, further comprising biasing elements connected to each lever and arranged to resist movement of the levers relative to the base and so provide a restoring force when the levers are moved.

16. A positioner according to any of claims 1 to 15, further comprising a mechanical stop connected to each lever to limit the amount by which it can move relative to the base.

17. A positioner according to any of claims 1 to 16, wherein the mechanical advantage of the levers acts to move the sample platform by an amount which is more than the movement of the drive mechanism.

18. A positioner according to any of claims 1 to 16, wherein the mechanical advantage of the levers acts to move the sample platform by an amount which is less than the movement of the drive mechanism.

19. A positioner according to any of claims 1 to 18, further comprising one or more strain gauges for measuring the positions of the levers.

20. A positioner according to claim 19, wherein the one or more strain gauges are coupled to respective bridge measuring circuits mounted on the positioner.

21. A positioner according to any of claims 1 to 20, comprising a further plurality of levers extending away from each other, the further levers being connected to the base and the drive mechanism so that actuation of the drive mechanism is transmitted to the further levers to cause them to move with respect to the base.

22. A positioner according to claim 21, each further lever being rotatably mounted on a fulcrum, thereby subdividing the further levers into inner and outer arms with the inner arms connected to the drive mechanism and the outer arms connected to the base.

23. A positioner according to claim 21 or 22, the drive mechanism being arranged to act on each of the further levers in the same direction.

24. A positioner according to any of claims 21 to 23, the drive mechanism being arranged to act on the further levers in a direction which is different to that in which it acts on the first mentioned levers.

25. A positioner according to any of claims 21 to 24, each of the further levers being aligned with a corresponding one of the first mentioned levers.

26. A positioner according to any of claims 21 to 25, the further levers being connected together by a flexible hinge.

27. A positioner according to claim 26, wherein the further levers are formed from a single cross member, the flexible hinge being provided by a thinned section of the cross member.

28. A positioner according to any of claims 22 to 27 when dependent on claim 8, the support walls also supporting the further levers, the further levers being connected to the support walls by flexible connections for providing the fulcrums.

29. A positioner according to claim 28, wherein each further lever and its support wall are of unitary construction, the flexible connection being provided by a thinned section at their junction.

30. A positioner according to claim 28 or 29, wherein the first mentioned, levers, the support walls and the further levers are of unitary construction.

31. A positioner according to any of claims 21 to 30, wherein the further levers are connected to the base by a pair of input linkages which are stiff in respect of forces applied along their axes of extent.

32. A positioner according to claim 31, wherein the input linkages are deformable in respect of forces applied transverse to their axes of extent.

33. A positioner according to claim 31 or 32, wherein the input linkages extend away from the input levers on the same side as that on which the drive mechanism is located.

34. A positioner according to any of claims 31 to 33, wherein the input linkages extend substantially parallel to a drive axis along which the drive mechanism supplies an actuation force.

35. A positioner according to any of claims 21 to 34, further comprising biasing elements connected to each further lever and arranged to resist movement of the further levers relative to the base and so provide a restoring force when the further levers are moved.

36. A positioner according to any of claims 21 to 35, further comprising a mechanical stop connected to each further lever to limit the amount by which it can move relative to the base.

37. A positioner according to any of claims 21 to 36, further comprising one or more strain gauges for measuring the positions of the further levers.

38. A positioner according to claim 37, wherein the one or more strain gauges are coupled to respective bridge measuring circuits mounted on the positioner.

39. A multi-axis positioner comprising a first positioner according to any of claims 1 to 38 aligned along a first direction and a second positioner according to any of claims 1 to 38 aligned along a second, different, direction, the first and second positioners connecting between a common base and a common sample platform.

40. A multi-axis positioner according to claim 39, wherein the first direction and the second direction are orthogonal to one another.

41. A multi-axis positioner according to claim 39 or 40, further comprising a third positioner according to any of claims 1 to 38 aligned along a third direction, the third direction being different to the first and second directions, the third positioner connecting between the common base and the common sample platform.

42. A multi-axis positioner according to claim 41, wherein the third direction is orthogonally arranged with respect to at least one of the first or second directions.